Wireless Sensor Network : LEACH Approach And Aggregation Protocol

G.Kanagaraj[1], T.Primya[2], G.Subashini[3]

[1] *Kumaraguru College of Technology, Coimbatore,India*
[2]*Dr.N.G.P.Institute of Technology , Coimbatore,India*
[3]*PSG College of Technology, Coimbatore,India*

Email: [2]primyacse@gmail.com

Abstract. In recent years Wireless sensor network technology is considered as an emerging technology where environmental physical conditions are monitored and recorded using multiple sensors. Central locations are worn for collected data organisation. Multi-hop communication is used to transmit data to sink node. To remove unwanted transmission, best known WSN method called Data aggregation is used. Its job is to collect information provided by many sensors and gives that entire data's to base station. Process of collecting information is done many times because for data efficiency. This method helps to reduce data transmission energy cost. A basic tree based structured approach is used for this entire process. To minimize usage of energy and find shortest path between sink and leaf nodes for data transmission tree-based method is used. Partition Pointed enquiry Region Routing Algorithm (PPERR) and Partition Enquiry Region Routing (PERR) Algorithm with LEACH are proposed algorithms. Collection of information and sensing is done in Protocol called Data aggregation is used in PPERR and in LEACH clustering approach is worn. Consumption of energy and extension of lifetime are major problems focused here. NS2 simulation is done for solving these problems.

Keywords: Clustering, Data Aggregation, Tiny-SQL, Tributaries and delta

1. INTRODUCTION

In case of communication and computer research areas WSN is considered as forge ahead technology. Using wireless links, monitored field is used to communicate gathered information through a network of devices. With help of gateway, information is transmitted through many nodes. Wireless Ethernet is used to connect other networks via data. It includes countless nodes and base station[1]. For network and user communication, sink or base station is used as intermediate. User can enter queries based on that results can obtain from sink.

In paper [2] and Paper [3] for data collection and result giving sink node is used. WSN is made up of many numbers of sensor nodes. Radio signals are used in sensor nodes for communication between themselves. Every single node in WSN has various facilities in it such as speed of processing, consumption of energy, bandwidth, and storage capacity. Once sensor nodes got installed, its major role is data collection with multi-hop communication includes in it. Sensory nodes are worn for data collection in data aggregation algorithm. To enhance lifetime of network this algorithm is used for data collection and grouping that data in an energy efficient way[2]. Various aggregation functions like SD, avg, Count and many

measured data are used here. Structure of routing decides data aggregation efficiency. Here tree-based routing structure through various point of view such as query aggregation processing, workload balancing and make use of sink mobility x knowledge. Tributaries and Deltas approach is combination of tree-based and multipath-based routing is explained in paper[3].
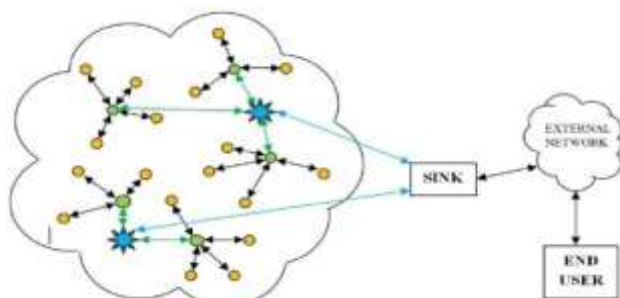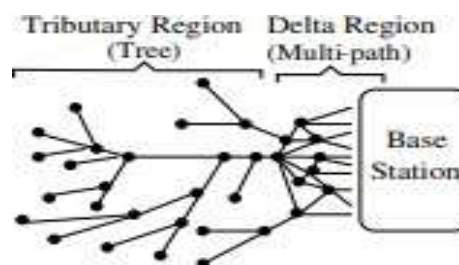

Fig. 1. Wireless Sensor Network

Fig. 2. Tributaries and Delta Regions

This method helps to run networks various regions at the same time. Various pros of WSN are no need of any inbuilt infrastructure, can reach any extremes like forest areas, depth of sea, top of mountains, any number of workstations can be included at any time, can lodge new devices at any moment, physical partitions also possible, can monitor using centralized machine[4].

2. TECHNIQUES USED

Clustering Technique: The widely used technique in WSN is Clustering Technique. Formation of cluster is done in network by grouping together all the sensors nodes present in it. After that head selection of cluster is foremost concept to consider[5]. CH (Cluster Head) selection is done by means of residual energy or by random selection based on every cluster energy level in network. By consumption of energy balancing method this helps to reduce communication overhead[6]. The main task of this approach is balancing the load in network, reduction of communication overhead, tolerance of fault detection, minimizing delay, and sensor network lifetime improvement.

Data Aggregation: Elimination of unnecessary data transmission and energy controlled WSN lifetime improvement is considered as main task of this protocol[7]. Multi-hop manner is used here for transmitting the data. All the nodes present were forwards its data to adjacent nodes which are nearby with sink. It's considered as method of collecting all sensor data's by means of aggregation approaches. Our algorithm works based on usage of sensor data from sensor node and aggregates it [8]. At last by efficient path selection data which are aggregated are transferred to sink node. Data collection from source node and transfer it to destination helps to decrease transmission number and also helps in reduction of usage of energy in sensor network. It helps to improve robustness and correctness of information in network. Load traffic is reduced in sensor network.
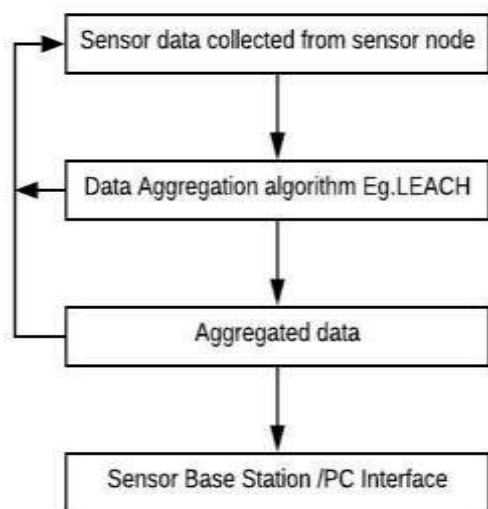
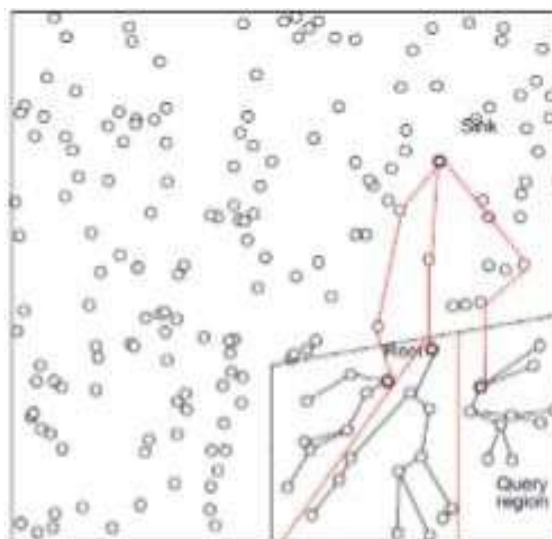**Fig. 3.** Architecture of Data Aggregation   **Fig. 4.** Routing tree construction

3. DIFFICULTIES AND QUERY FORMATION

Difficulties: User submit query over sensor network, if they need any details from network, for that he/she connects to sink node. It is based on query language called Tiny-SQL. It helps to withdraw required information from network[9]. It helps to collect, summarize all the needed data by user. In case of small-case sensor network, within a query region sink node is located. At sink node area aggregation tree is constructed which acts as real root of tree. Here tree splitting cannot be done. It helps in separation of sink from root and begin point to point route from root to sink.

Effective increment of load is done at point-point communication which helps to share nodes of aggregation tree. Lifetime improvement also checked here. User can transfer only remote areas of network not entire WSN in large scale WSN[10]. To protect contention of wireless medium, aggregation tree area construction should be in limit to help load reduction. In Fig.4 network area is dissect into three split trees and roots into three sub enquiry region which helps to send results to sink. For transmission of data, geographical-based shortest-path routing is used.

Query Formation: WSN includes N nodes, $S_N = \{S1, S2, S3...SN\}$, based on GPS/ beacon message every node knows its location[11]. Around its communication range all node fins location of at least any one of one-hop neighbour. If geographic location does not change for many hours, then it is static. Query Q is defined by six tuples where Sink is Sink node's ID considered as packets final destination. QR is the value based on geographical location. S_{val} is monitoring value. F is query sampling frequency. Δ is duration over nodes. Type is string which performs all aggregate functions. At node, to build routing tree Standard geographical routing protocol is used

4. DISJOINT TREE MULTIPATH ROUTING

This method is used to balance load, consumption of low energy which extend lifetime of network and transmission robustness. Comparison between 2 algorithms is done based on these features. For routing if multiple trees are used, then query Q result based on geographic

location. Routing is done based on GPRS with multiple trees. AQRDR divided into 4 stages. 1) Division of Query region. 2) Query message distribution 3) Routing tree construction 4) Sensor Reading collection. Data aggregation minimizes transmission levels towards base station. It helps to reduce minimum overhead.

Query Region Division Routing Algorithm with LEACH: Consumption of energy in sensor network is done in QRDR algorithm with LEACH. Data transmission is done by two ways as inter and intra regions to detect hole in routing network. It involves 2 phases i.e., Setup phase and steady state phase. In setup phase formation of cluster and selection of cluster head undergoes. It is done by means of user query. Based on random selection of all nodes, cluster head is selected. Based on cluster formation every node sends their data to cluster head in steady state phase. Communication is done by single-hop method. All the collected data in cluster head is grouped and transfer to sink or base station. Then network again goes back to first phase. Results are uneven distribution of clusters. Clusters may vary in numbers of nodes. It may locate at head or edge of network. It helps to increase the consumption of energy and helps in improvement of network performance.
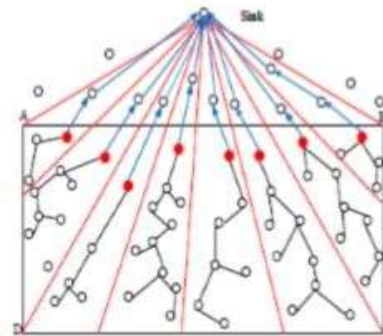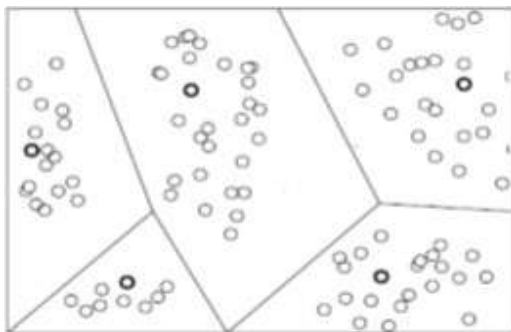

Fig. 5. Partition Enquiry Region Routing (PERR) **Fig. 6.** The Pointed enquiry Region Algorithm with LEACH

5. CONTRAST BETWEEN PPERR AND LEACH ALGORITHM

PPERR outperforms than LEACH Algorithm. Sensing of data from nodes and transfer back to sink node path is short in PPERR, Consumption of energy is less. Random selection of cluster head will raise some difficulties in network, here data from cluster node does not reach its specified destination-Base Station. Root nodes increases in enquiry region if there is increment in sub enquiry region. Hence there is a chance of formation of space in sink node if it is between intermediate nodes and aggregated rooted nodes. Fig 7 to 10 shows energy consumption comparison in terms of number of sensor nodes, region division, PDR ratio and size of sensor data between these two algorithms. The distance between intermediate nodes and aggregated rooted nodes is closer to sink node.
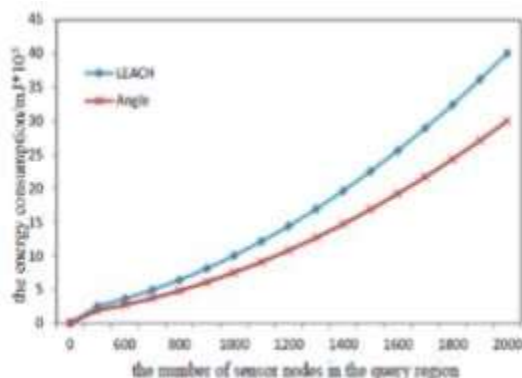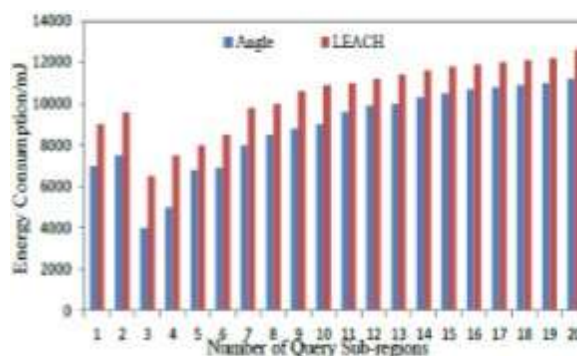
Fig. 7. Energy consumption of no. of nodes

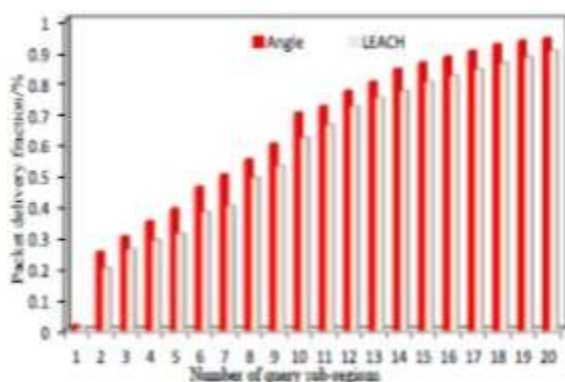**Fig. 8**. Energy Consumption Comparison

Fig. 9. Comparison based on Enquiry partition
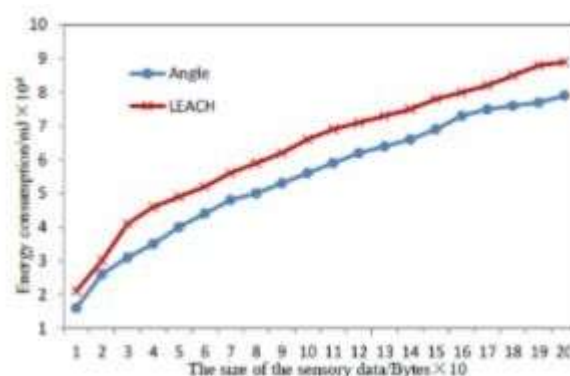

Fig. 10. Energy Consumption Vs Size of data

6. CONCLUSION

In our paper WSN algorithms such as LEACH and Partition Pointed enquiry Region Routing Algorithm (PPERR) study is done. Discussion is done on consumption of energy and network lifetime for its performance optimization. To remove unwanted transmission, Data aggregation is used. For maximizing the lifetime of network in large scale sensor network these algorithms will well suit.

7. REFERENCES

[1]. Wan, Shaohua & Zhang, Yu-Dong & Chen, Jia: "On the Construction of Data Aggregation Tree With Maximizing Lifetime in Large-Scale Wireless Sensor Networks" ,IEEE Sensors Journal. 16. 1-1. 10.1109/JSEN.2016.2581491(2016).

[2]. F. Ren, J. Zhang, Y. Wu, T. He, C. Chen and C. Lin: "Attribute-Aware Data Aggregation Using Potential-Based Dynamic Routing in Wireless Sensor Networks,", IEEE Transactions on Parallel and Distributed Systems, vol. 24, no. 5, pp. 881-892, doi: 10.1109/TPDS.2012.209(2013).

[3]. L. Wang, R. Christensen, F. Li and K. Yi: "Spatial online sampling and aggregation", Proc. 42nd Int. Conf. Very Large Data Bases (VLDB), pp. 1-12, Aug.(2016).

[4]. J. Niedermayer, M. A. Nascimento and M. Renz: "Continuous quantile query processing in wireless sensor networks", Proc. 17th Int. Conf. Extending Database Technol. (EDBT), pp. 247-258, Mar. (2014).

[5]. W. Pu, D. Rui and I. Akyildiz: "Collaborative Data Compression Using Clustered Source Coding for Wireless Multimedia Sensor Networks", *Proc. IEEE INFOCOM*, pp. 1-9, (2010.)

[6]. Xue, Y., Cui, Y. & Nahrstedt.: " . Maximizing Lifetime for Data Aggregation in Wireless Sensor Networks. Mobile Network Application", 10, 853–864. https://doi.org/10.1007/s11036-005-4443-7(2005).

[7]. L. Wang, P.-J. Wan and K. Young: "Minimum-latency beaconing schedule in duty-cycled multihop wireless networks", *Proc. IEEE INFOCOM*, pp. 1311-1319, Apr. (2015).

[8]. J. Li et al.: "Approximate holistic aggregation in wireless sensor networks", *ACM Trans. Sensor Netw.*, vol. 13, no. 2, pp. 1-24, Jun. (2017).

[9]. M. Bagaa, M. Younis and D. Djenouri,: "Distributed low-latency data aggregation scheduling in wireless sensor networks", *ACM Trans. Sensor Netw.*, vol. 11, no. 3, pp. 1-36, Apr. (2015).

[10]. Krishanmoorthy, Sujatha, et al. "A Study on Optimization of Network latency and Pocket loss Rate." IOP Conference Series: Materials Science and Engineering. Vol. 937. No. 1. IOP Publishing, 2020.

[11]. P. Prabu, Ahmed Najat Ahmed, K. Venkatachalam, S. Nalini, R. Manikandan,Energy efficient data collection in sparse sensor networks using multiple Mobile Data Patrons, Computers & Electrical Engineering,Volume 87,2020,